



# FOREST PEST MANAGEMENT

## Pacific Southwest Region

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### EVALUATION OF PINE PLANTATIONS ON THE MILFORD RANGER DISTRICT, PLUMAS NATIONAL FOREST, FOR SUPPRESSION OF WESTERN DWARF MISTLETOE

Melissa Marosy, Plant Pathologist

#### ABSTRACT

Three pine plantations on the Milford Ranger District of the Plumas National Forest, representative of plantations covering over 20,000 acres of the District, were evaluated for western dwarf mistletoe infestation. All three plantations were found to be heavily infested, or to have a high probability of becoming infested within the next five years. Alternative treatment measures are discussed.

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On August 31 Tom McGrath, Reforestation Specialist, Al Vazquez, District Silviculturist, and I visited three plantations on the Milford Ranger District of the Plumas National Forest. Tom McGrath had requested an evaluation of the western pine dwarf mistletoe (Arceuthobium campylopodum) problem widespread in pine plantations on the district. The Milford Ranger District experiences 70-80 lightning-ignited fires per year, an incidence higher than that on any other district in Region 5. The District currently has over 20,000 acres of plantations, primarily a result of these burns. Mistletoe-infected resistant trees were left in many of these plantations; many of the plantations are also bordered by merchantable mistletoe-infested pine stands.

The District intends to request Forest Pest Management funding to conduct a survey of the distribution and severity of the dwarf mistletoe infestation in and around these plantations, in order to obtain the data necessary to plan a District-wide dwarf mistletoe suppression effort. In addition, a recommended treatment for three plantations representative of worst case scenarios on the District was desired.

## BIOLOGY AND IMPACTS OF WESTERN DWARF MISTLETOE

Dwarf mistletoes (Arceuthobium spp.) are parasitic, flowering plants that can only survive on living conifers in the Pinaceae. They obtain most of their nutrients and all of their water and minerals from their hosts. Western dwarf mistletoe (A. campylopodum) infects principally ponderosa, Jeffrey, and knobcone pines, and occasionally Coulter and lodgepole pines.

Evidence of mistletoe infection includes the presence of aerial shoots, swollen branches, and witches' broom. Aerial shoots produce seeds which are forcibly discharged in the fall. These seeds have a sticky coating which allows them to adhere to surfaces they contact. Seeds that land on needles and twigs of a host will overwinter there and germinate the following spring. The radicle of the seed penetrates the bark of 1-yr-old twigs and develops an endophytic system in the inner bark and sapwood. In two to four years, this infection produces new aerial shoots which flower and produce seed in another two to four years.

The spread of dwarf mistletoe is limited to the distance travelled by the seed, which from overstory to understory is usually 20-60 feet; wind may carry the seeds as far as 100 feet from their source. A rule of thumb is that dwarf mistletoes can spread a horizontal distance equal to the height of the plants in the infected tree as long as the seeds are not intercepted. The actual spread rate through an even-aged, single species stand is one to two feet per year. Vertical spread in a tree crown is about 4 inches per year.

Western dwarf mistletoe is a major cause of mortality, growth loss, and reduced vigor of ponderosa and Jeffrey pine. Past statewide surveys indicate that during drought years, dwarf mistletoes as a group are involved in about 40% of the conifer mortality. During years of normal precipitation, this proportion drops to about 20%. Dwarf mistletoes also cause significant declines in tree growth and stand productivity. The amount of growth reduction depends on the incidence and severity of infection, and on site quality. Methods for determining the growth loss occurring in a specific stand have not been developed, but a rough estimate for lightly infected stands on an average site is 10 cu ft/ac/yr. This is 6-8% of the mean annual increment. Stands with heavier mistletoe infections would have greater impacts on growth.

### FERRIS PLANTATION

The Ferris plantation is a 3500 acre area which burned in 1973 and was planted in 1977 with ponderosa and Jeffrey pine. Site class is Dunning 3 to 4. The portion visited was in Section 9, T25N, R15E. Residual pines are 70-100 years old, with some 120-150 years. Nearly 100% of the residual trees within the plantation and those in the adjacent stand are infected with dwarf mistletoe. Fifty to seventy-five percent of these trees are heavily infected (dwarf mistletoe rating of 5 or 6). The planted trees are moderately to heavily infected near the residuals and the adjacent stand; trees in the center of the plantation and not near residuals are lightly infected or apparently free of infection.

## Management Alternatives

1. No Action. Dwarf mistletoe will continue to spread throughout the plantation and intensify in those trees already infected. Spread from the residual trees would be expected to occur to a distance equal to the height of the infected residual trees. Horizontal spread within the plantation stand would be expected to occur at a rate of 1-2 feet per year. Infected plantation trees will have slower growth than uninfected trees, and may never reach merchantable size. The trees will be more susceptible to bark beetle attack, and more likely to experience mortality following drought years.

2. Remove Infected Residuals. All infected residuals would be removed. These could be girdled and left for wildlife trees if protection of nearby residual trees is not a concern. Treatment of the residuals in this manner would eliminate the primary source of inoculum in the plantation. Future spread of the mistletoe would include horizontal spread from the currently infected plantation trees (expected to occur at a rate of 1-2 feet per year) and vertical spread within trees, which occurs at a rate of about 4 inches per year. Additional spread of the parasite into the plantation would continue from the adjacent infested stand.

3. Precommercial Thin Plantation Trees. A precommercial thinning within the plantation would be conducted, favoring those trees most heavily infected with mistletoe. The plantation is currently somewhat overstocked, and removal of the more heavily infected trees would serve to reduce the levels of inoculum in the stand and allow the remaining trees to grow more vigorously. Vigorous trees can more easily withstand the effect of dwarf mistletoe infection, are less apt to experience growth loss due to the parasite, and are less apt to succumb to the parasite in drought years. Some infection would remain in the stand, and the parasite would spread slowly to the remaining trees. Spread would also continue from any residuals which are left in the stand, and from the adjacent stands.

4. Treat Adjacent Stands. Infected trees in the adjacent stands should be cut such that no inoculum is within range of the plantation trees. A rule of thumb is to leave a buffer strip free of dwarf mistletoe which is equal in width to the height of the highest infection in the adjacent stand. Such a buffer strip would prevent further spread of the parasite into the edges of the plantation. Infection currently present in the plantation would not be affected, and would continue to spread throughout the crowns of infected trees and to adjacent trees.

## LOOKOUT PLANTATION

The Lookout plantation is a 26 acre tract of Dunning site class 3 in Section 5, T27N, R13E. Site preparation was done with tractor in 1986, followed by chainsaw elimination of all trees visibly infected with dwarf mistletoe. The area was planted in 1987 with 2-0 Jeffrey pine; no buffer was left between the regeneration and the adjacent stand. The adjacent stand has a high proportion of white fir, with some large (approximately 125-year-old) pine mixed in. Indications of past mistletoe infection (brooms) are present in the adjacent pines, although actual mistletoe plants were not observed. Dwarf mistletoe

infections are now visible in the residual pine, which are about 20 feet in height, although the regeneration currently appears uninfested.

#### Management Alternatives

1. Do Nothing. The plantation trees will eventually become infected with dwarf mistletoe from the infected residuals. Infection can be expected to show up within three years of planting, in 20-foot radii around the infected residuals. Additional infection may occur from the pines in the adjacent stand. As the plantation trees grow and the infections in them become established, horizontal spread of the parasite will occur outside of the initial radii. A large portion of the plantation will eventually become infected. These trees will be more susceptible to bark beetle attack and to drought. They will have reduced growth, and may never reach merchantable size.
2. Remove Infected Residuals. Treat as for the Ferris plantation.
3. Create a Buffer Strip Around the Plantation. The component of white fir in the adjacent stand is great enough that, with the removal of all pine within approximately 100 feet of the plantation border, the fir would serve as an effective buffer strip around the plantation. The buffer strip should be at least as wide as the highest mistletoe infection remaining in any pines which are left in the adjacent stand. The creation of such a buffer strip would effectively prevent additional infection of the plantation from outside its boundaries, and, if no additional treatment is done, would isolate the infected plantation and prevent spread into new plantations which may be created in the future adjacent to the plantation in question.

#### THOMPSON PLANTATION

The Thompson plantation, 4 acres in Section 33, T28N, R13E, was planted in 1988 with 2-0 Jeffrey pine and incense-cedar. Fifty- to seventy-year-old pine residuals were left in the plantation, which is surrounded by a mixed stand of white fir and 125- to 150-year-old pine. Both the adjacent stand and the residuals are heavily infected with dwarf mistletoe. Incense-cedar was intended to be planted in a 50 foot buffer strip between the plantation and the adjacent stand, but was instead mixed throughout the plantation. Both the adjacent pines and the 50- to 70-year-old residuals are heavily infected with dwarf mistletoe.

#### Management Alternatives

1. Do Nothing. The pine seedlings will eventually become infected with dwarf mistletoe from both the residuals and the adjacent infested stand. Rates of infection and spread similar to those predicted for the Lookout plantation could be expected.
2. Remove Residuals. Treat as suggested for the Ferris and Lookout plantations.

3. Create a Buffer Strip. Remove all pines within 100 to 150 feet from the borders of the plantation and plant with a non-susceptible species such as incense-cedar. The buffer strip should be at least as wide as the height of the highest infection in any remaining adjacent trees. This would prevent further infection of the plantation from the adjacent stand. If no other treatment is done within the plantation, the creation of a buffer strip at this time could prevent movement of the parasite out into plantations which might be created in the future adjacent to the Thompson plantation.

#### INTEGRATED PEST MANAGEMENT

Dwarf mistletoe is often only part of a larger set of stand, site, and pest factors. Before treatment, each area should be evaluated thoroughly to ensure that all pests are considered in the management alternative(s) selected.

Consider treating all stumps created through tree removal with borax to prevent the establishment of annosus root disease caused by H. annosum. Treat all slash generated to reduce the risk of pine engraver beetle (Ips spp.) buildup. Slash created in the spring or early summer should be either lopped and scattered, piled and burned while green, chipped, or removed to a location lacking susceptible hosts.

Some trees may be girdled, rather than removed, to serve as wildlife trees. However, this should not be done if mature pines are to be left within about 20 feet of the girdled pine. Girdled pines may be attacked by bark beetles which emit aggregating pheromones. These beetles may attack any nearby pines within about 20 feet of the girdled pines, resulting in the death of nearby leave trees. If uninfected residuals are to be left nearby, the trees to be treated should be felled rather than girdled.

#### DISCUSSION

The dwarf mistletoe problem on the District is quite severe and should be addressed in a timely fashion to prevent further spread and intensification of the parasite into and within the extensive pine plantations on the District. Two of the plantations examined, the Lookout and Thompson plantations, do not yet have infection in the regeneration; however, a serious mistletoe problem can be expected to develop in the future if action is not taken immediately. This situation is common on the District, and presents an opportunity for controlling the parasite before it becomes a more serious problem on these plantations than it currently is. It cannot be stressed enough how important it is to prevent dwarf mistletoe from becoming established in these plantations, while it is still relatively easy to do so.

To adequately control the dwarf mistletoe problem on the Ferris, Lookout, and Thompson plantations, a combination of the proposed treatments is appropriate. Any one treatment alone will not suffice to sufficiently slow the spread of the parasite and prevent further infection of young plantations.

A District-wide survey is recommended to determine the incidence and severity of the mistletoe problem throughout the remaining plantations on the District. Once the incidence and severity are determined, the treatments recommended for

the Ferris, Lookout, and Thompson plantations can be applied to other similar plantations on the District. Should a situation be discovered for which the management alternatives in this evaluation do not appear to be adequate, a second biological evaluation can be requested.

Funding is available from the Regional Office, through Forest Pest Management, to implement all steps of a dwarf mistletoe suppression program. These steps include (1) a biological evaluation, (2) a pre-suppression survey of the infested areas to determine the extent of the infestation and which treatment or combination of treatments will be implemented, (3) the actual treatment, (4) a post-suppression evaluation, and (5) reentry to treat residual infections, if needed. This document will serve as the biological evaluation. The FPM staff can also assist with the pre-suppression survey and post-treatment evaluation, at the request of the Forest or District.

Forest Pest Management funds may be used for surveys and evaluations, residual tree removal, sanitation (for the sole purpose of dwarf mistletoe suppression), and destruction of stands on potentially productive sites that cannot be economically harvested and otherwise have no practical management potential. Forest Pest Management funds cannot be used to replace stands that are destroyed, or for associated thinning, planting, or other silvicultural practices. To request suppression dollars the District must submit to FPM for approval (1) a project proposal, Form FS-3400-2, and (2) an environmental assessment that includes project objectives, a biological evaluation (this document), a project work plan, an analysis of economic efficiency (FSM 1970 and 3422), and a post-suppression evaluation plan.